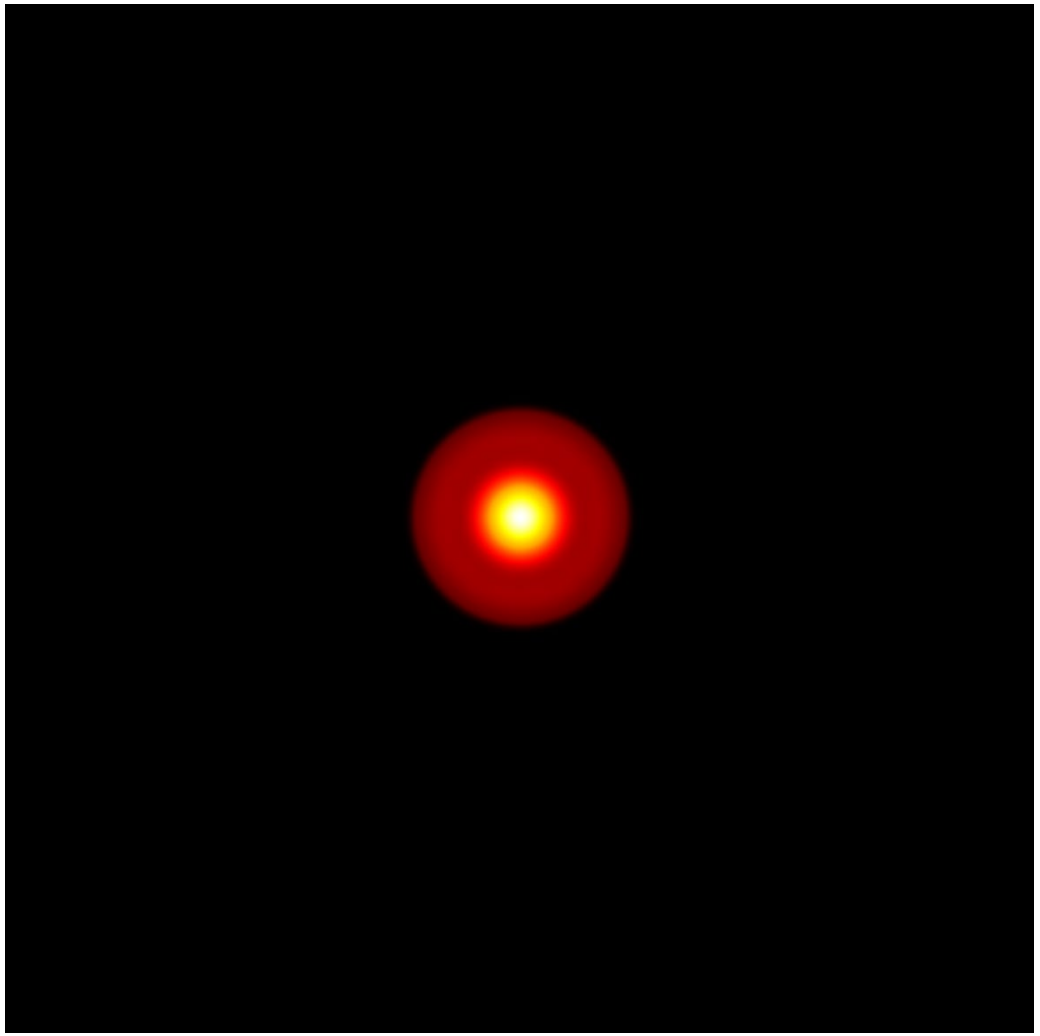
Laser Beam “Clean-Up” with Spatial Filter

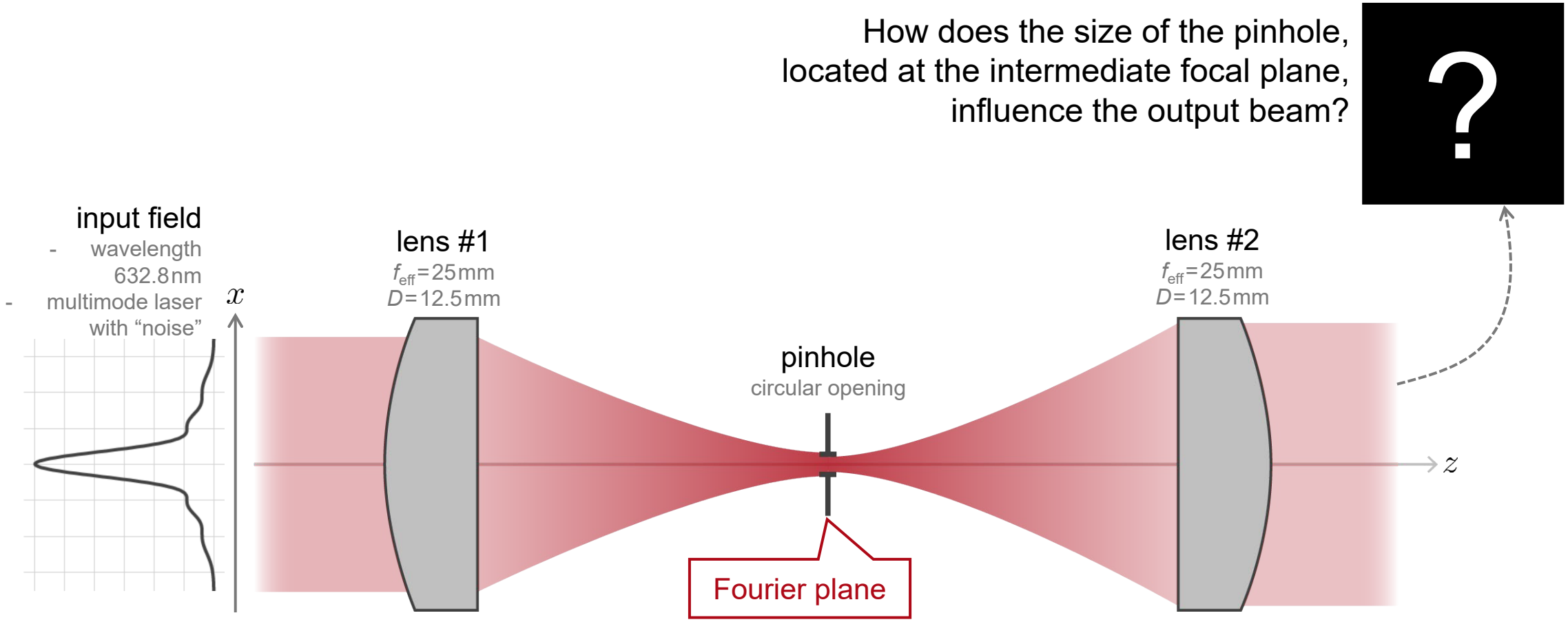
Abstract



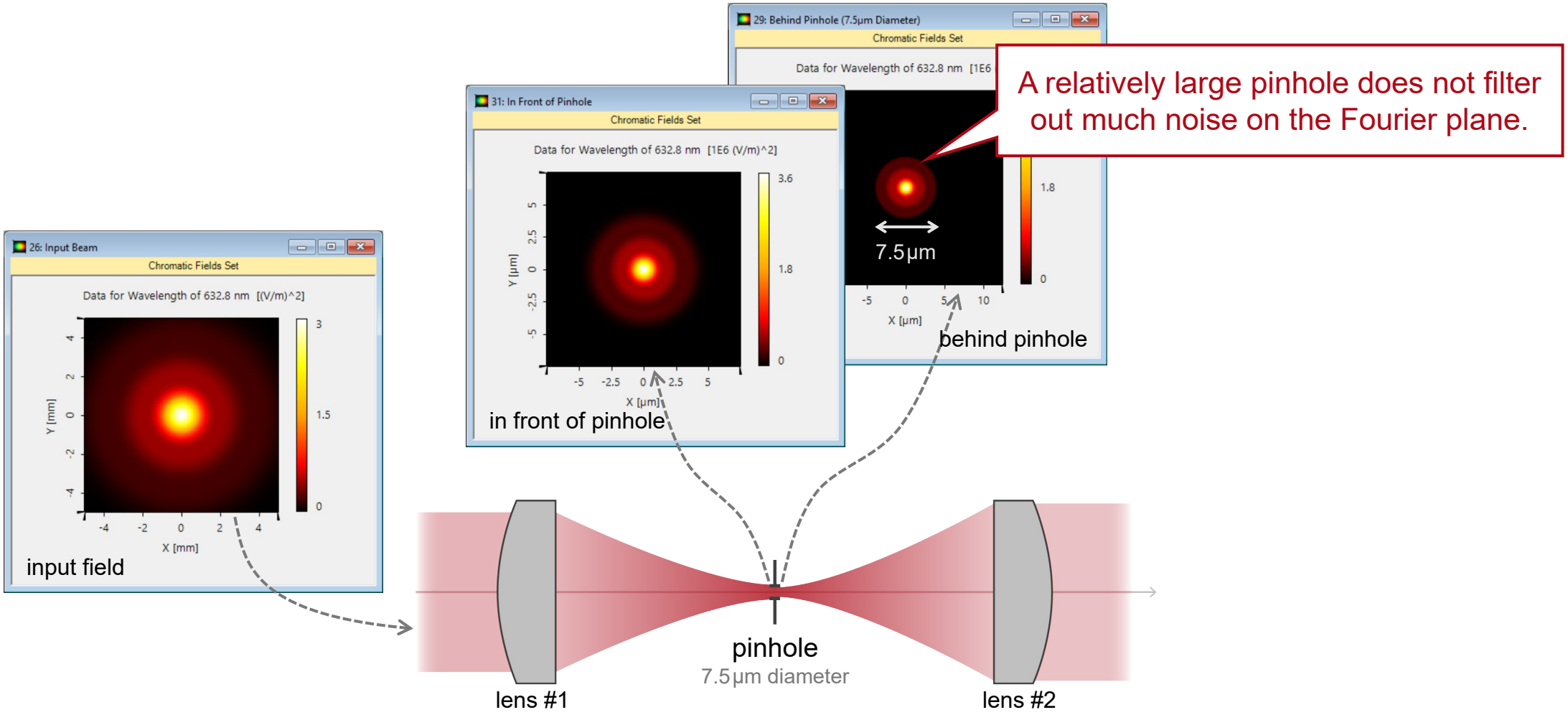
To obtain good beam quality is important for many laser applications, and a typical experimental method to obtain good beam quality is the spatial filtering. Within a spatial filtering system, a pinhole is placed on the intermediate focal plane (i.e. the Fourier plane) to get rid of the unwanted spatial frequency components. To model such systems, one must consider the diffraction from the pinhole and the diffraction property of the laser beams, and we demonstrate the spatial filtering effect in this example.

Modeling Task

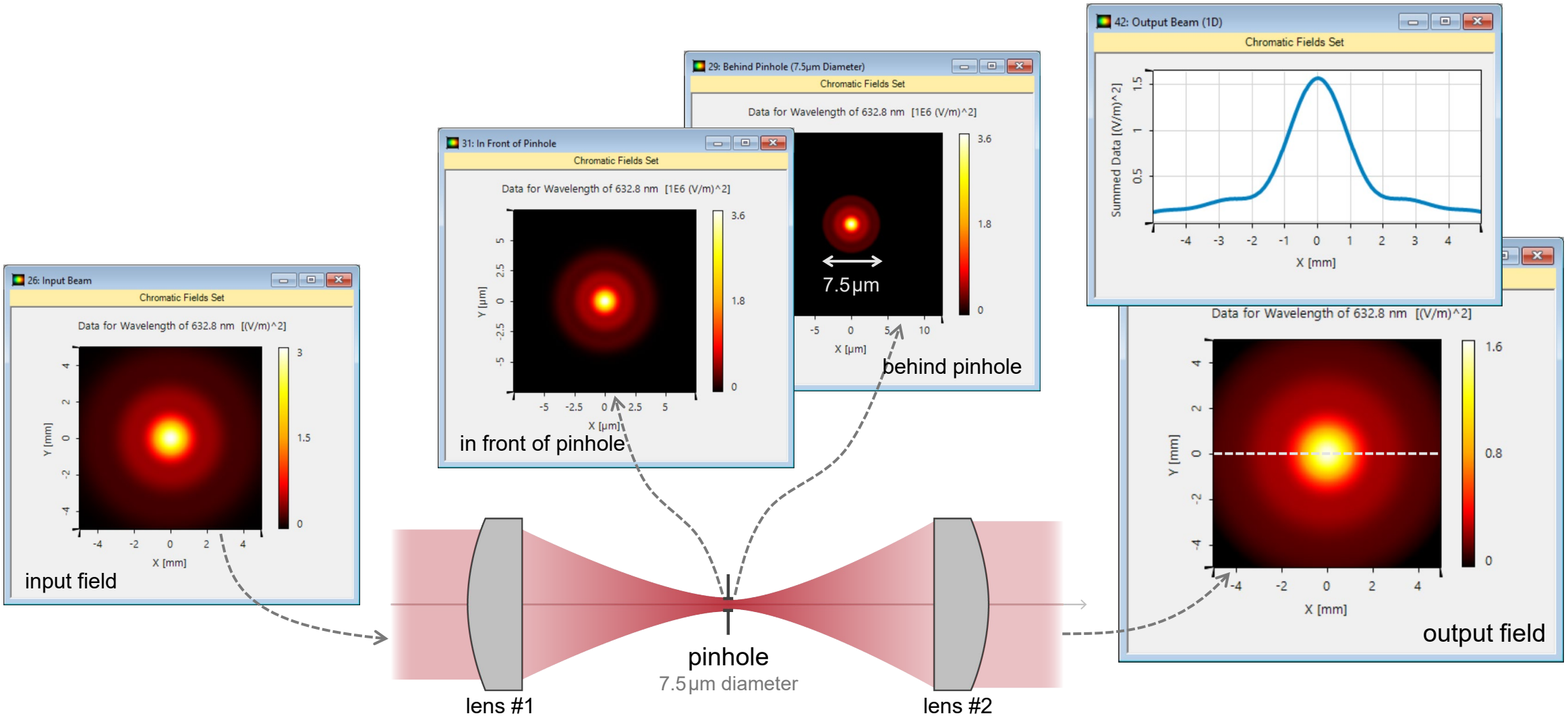
How does the size of the pinhole, located at the intermediate focal plane, influence the output beam?



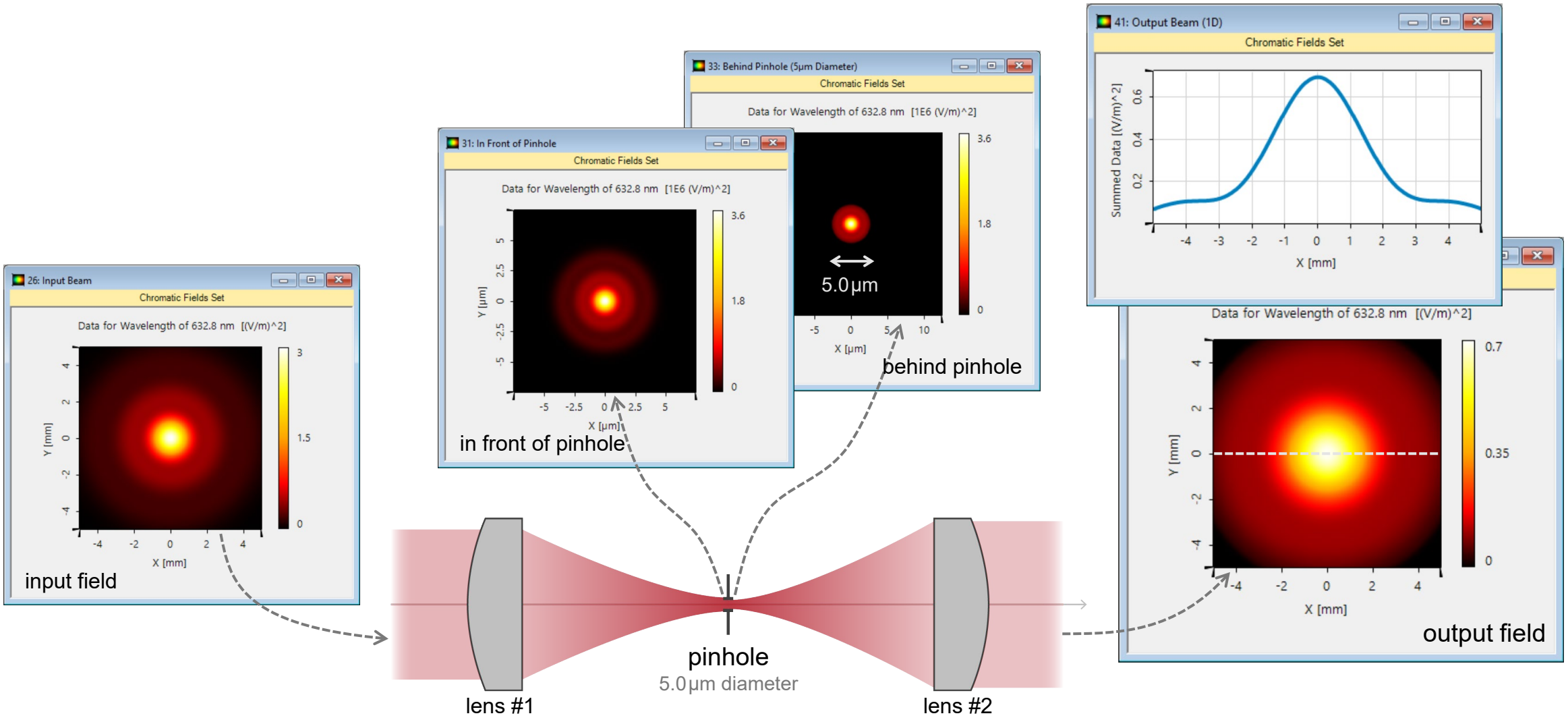
Spatial Filter with 7.5µm-Diameter Opening



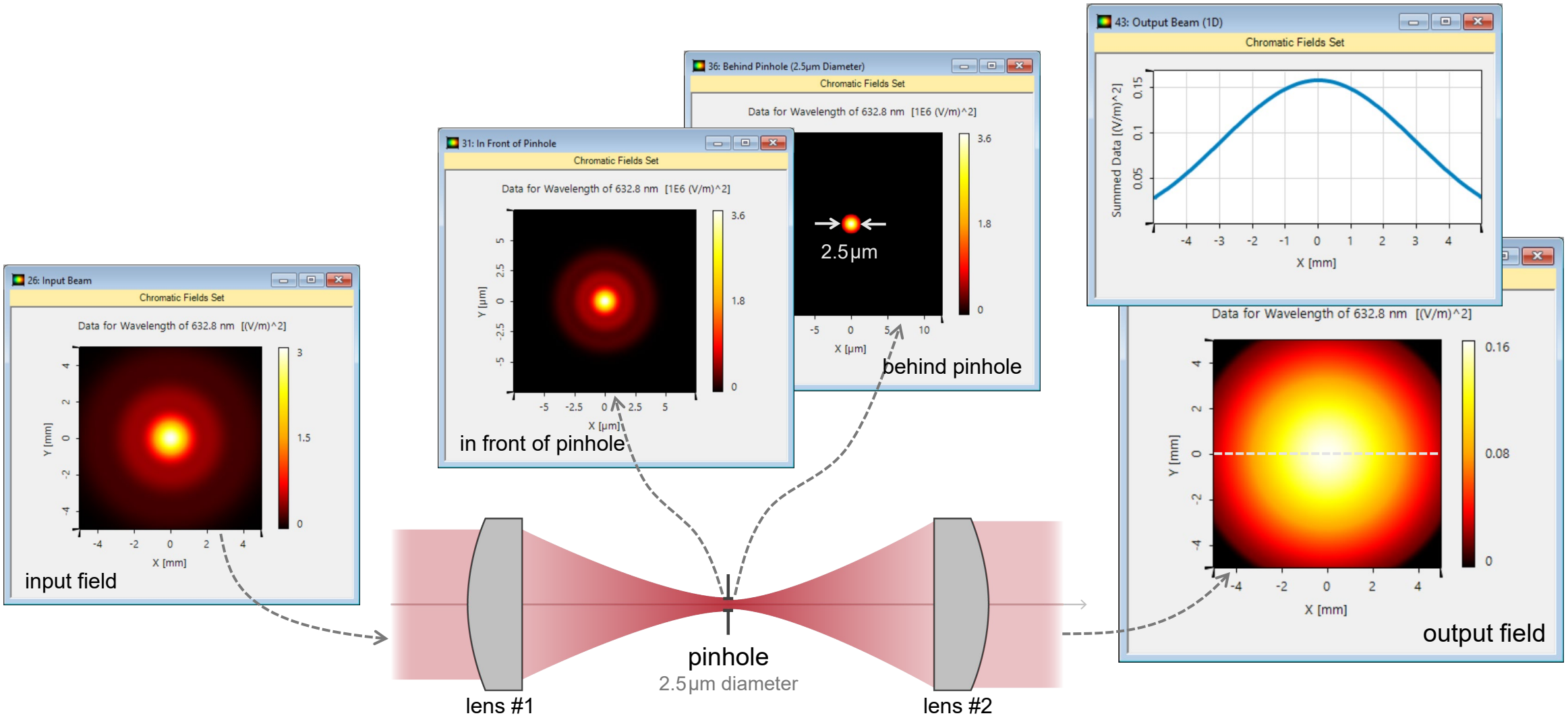
Spatial Filter with 7.5µm-Diameter Opening



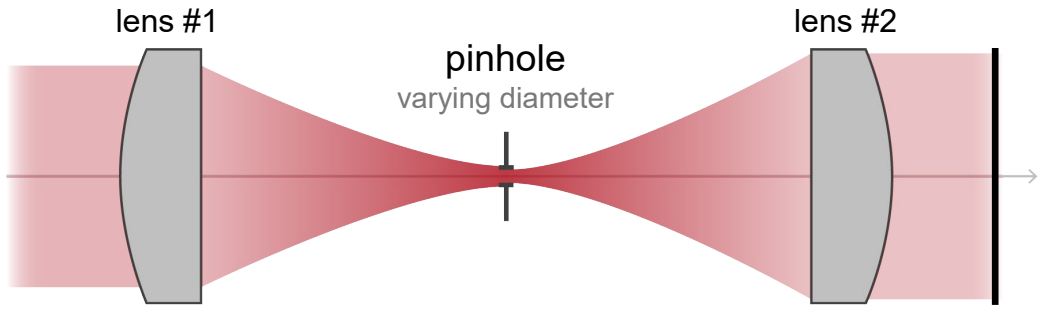
Spatial Filter with 5.0 µm-Diameter Opening



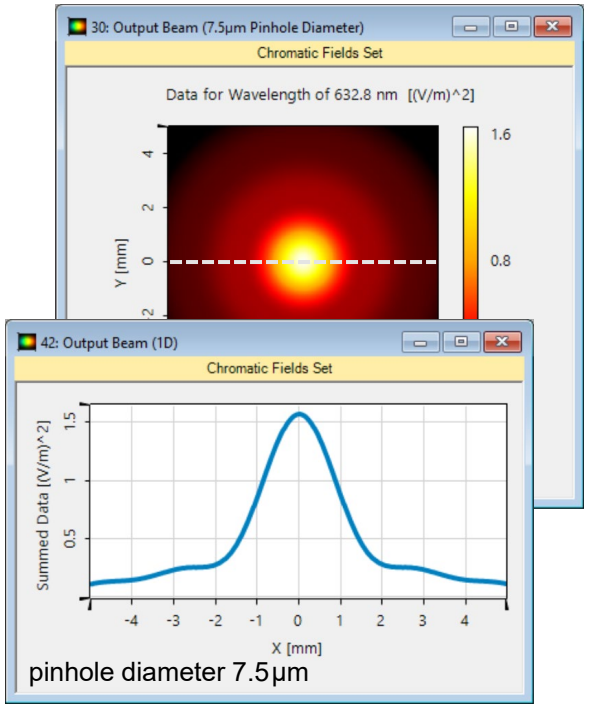
Spatial Filter with 2.5µm-Diameter Opening

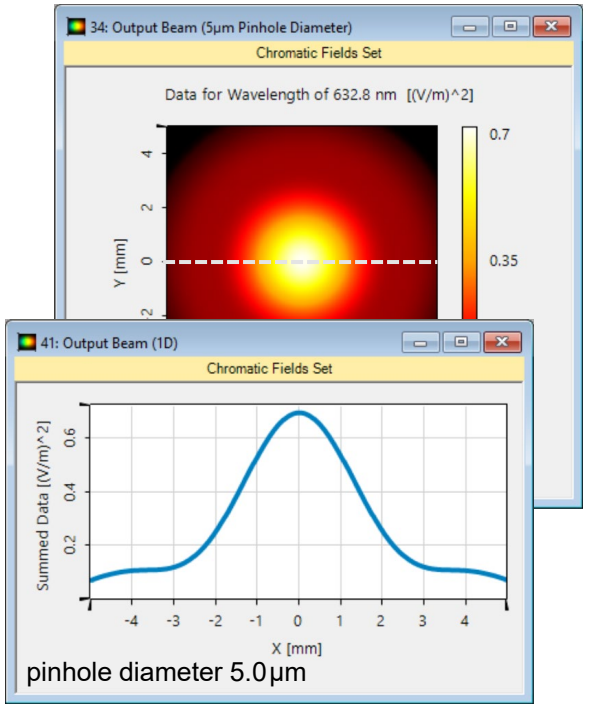


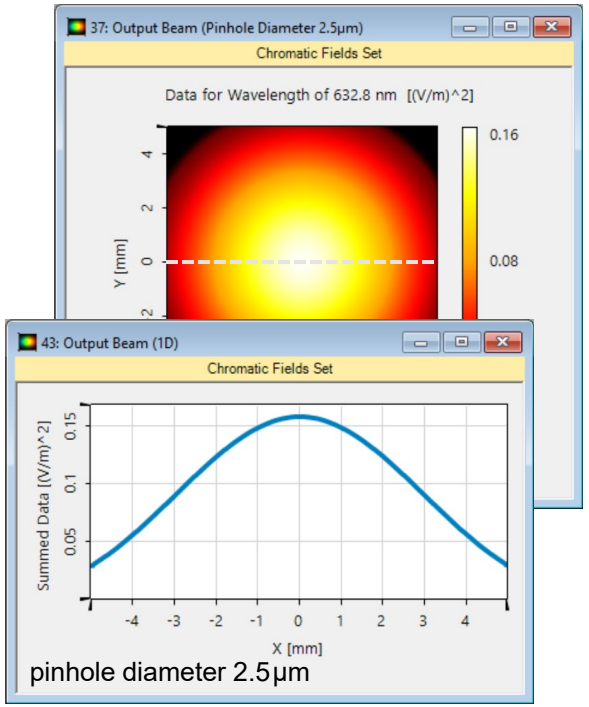
Output Beam Profile and Power Comparison



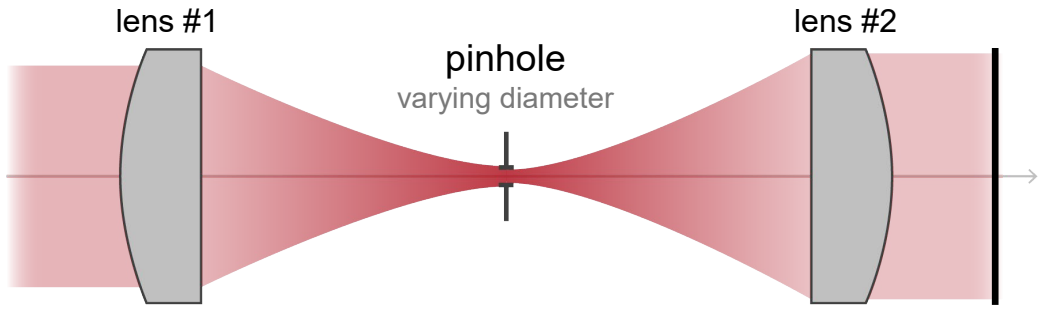
Spatial filter in the Fourier plane helps reduce the higher-frequency noise, therefore leads to better output beam profiles.



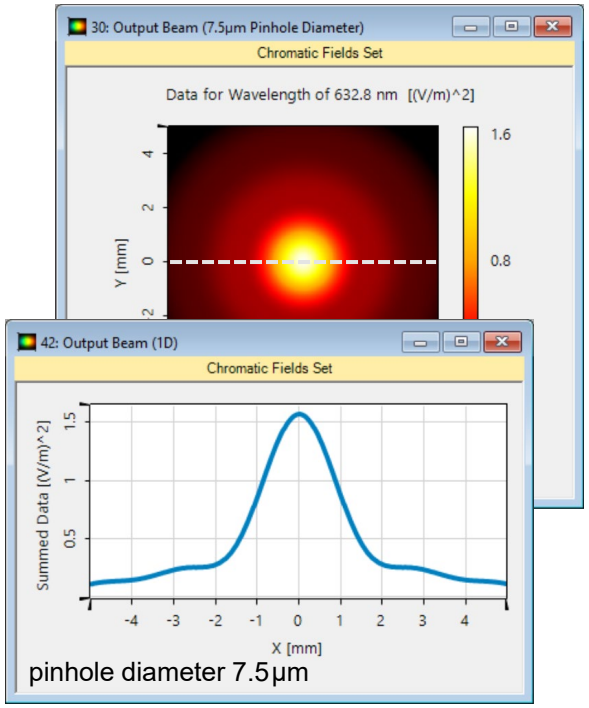




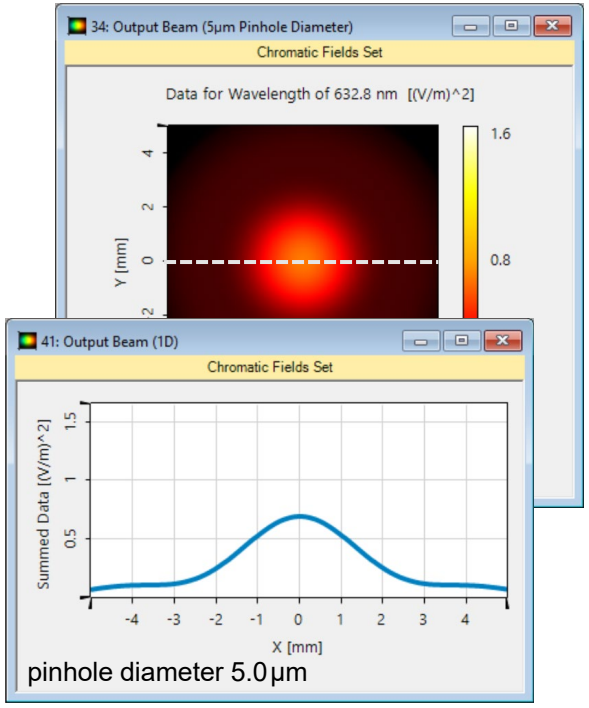
Output Beam Profile and Power Comparison



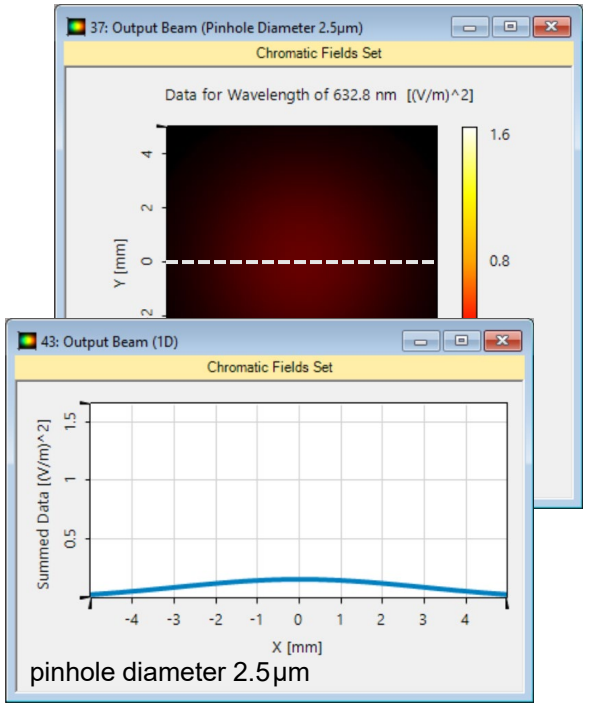
Relatively small pinhole limits the transmitted light and, as a consequence, leads to relatively large loss of power.



pinhole diameter 7.5µm



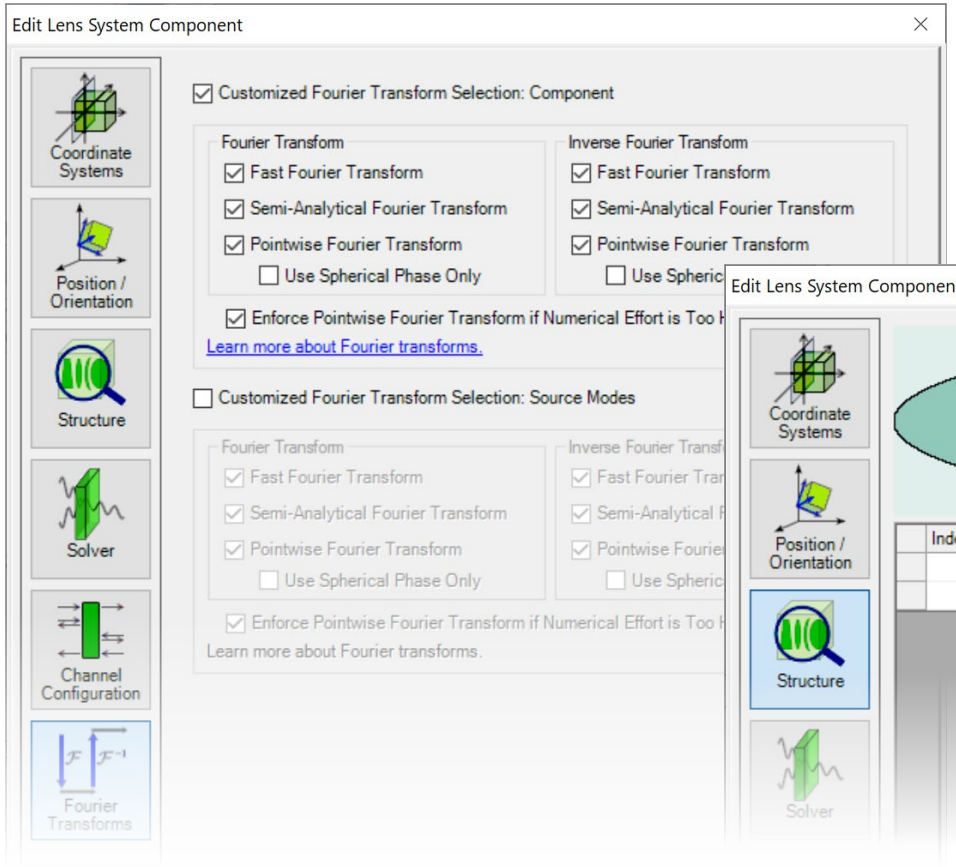
pinhole diameter 5.0µm



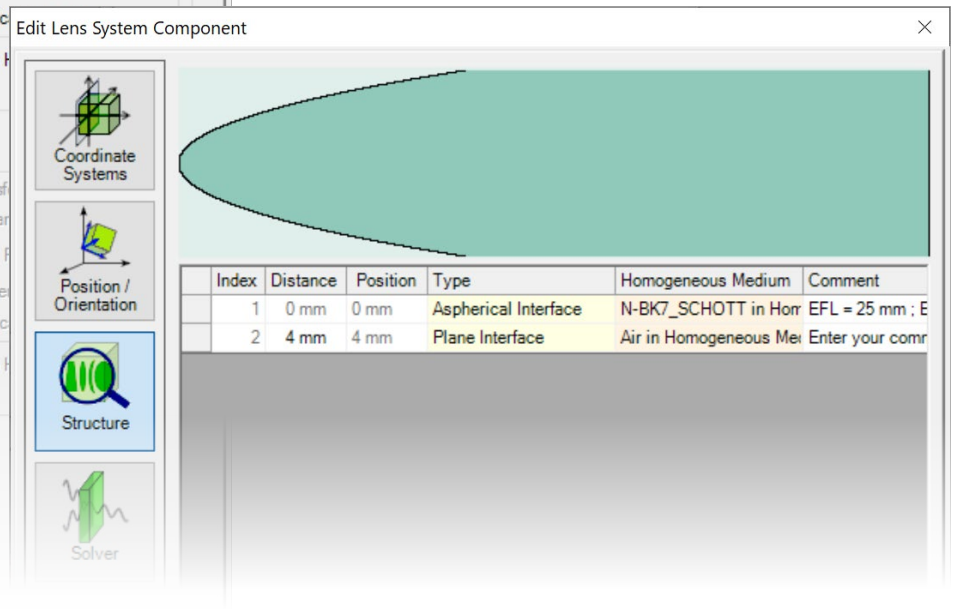
pinhole diameter 2.5µm

Peek into VirtualLab Fusion

flexible consideration of diffraction
via Fourier transform settings

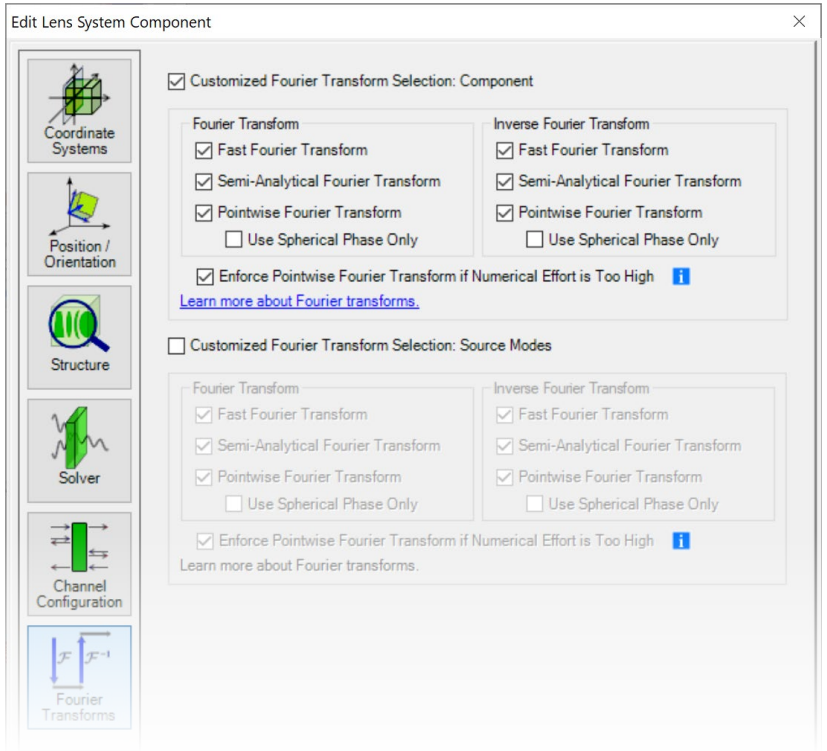


real lens modeling for laser beams

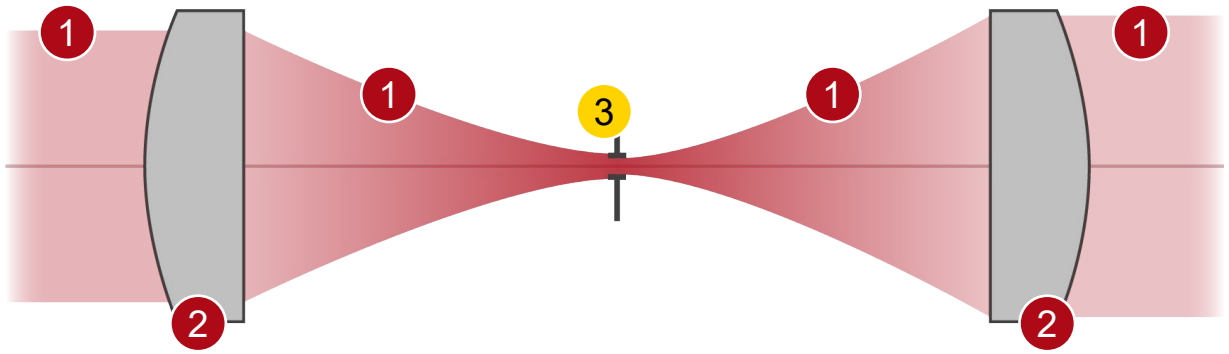


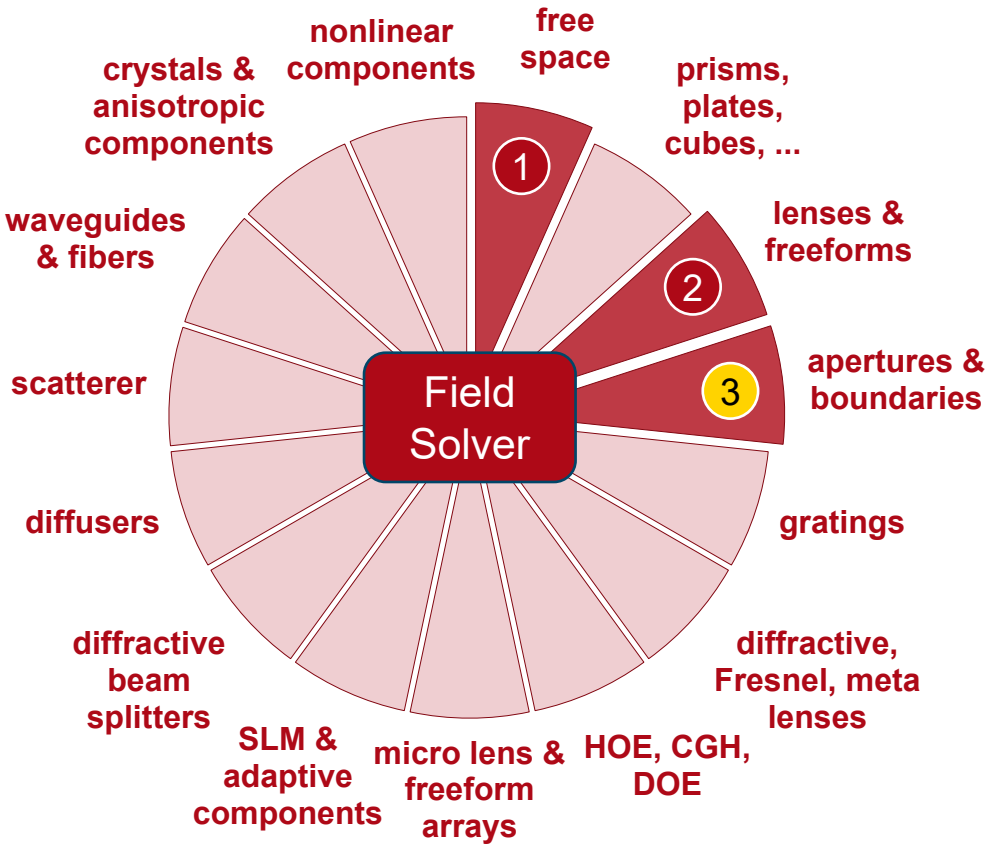
Workflow in VirtualLab Fusion

- Set up input Gaussian field
  - Basic Source Models [Tutorial Video]
- Import lens systems from Zemax OpticStudio®
  - Import Optical Systems from Zemax [Use Case]
- Set the position and orientation of components
  - LPD II: Position and Orientation [Tutorial Video]
- Set the Fourier transforms properly



VirtualLab Fusion Technologies





Document Information

title	Laser Beam “Clean-Up” with Spatial Filter
document code	MISC.0082
version	1.0
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software version	2020.1 (Build 1.202)
category	Application Use Case
further reading	- Pinhole Modeling in a Low-Fresnel-Number System - Automatic Selection of Fourier Transform Techniques in Free-Space Propagation Operator